

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Cancelled)

2. (Currently Amended) An outlier and change point detection device ~~that calculates the~~ for ~~calculating outlier score scores and the change point score scores for the data described with~~ calculating outlier score scores and the change point score scores for the data described with ~~the a sequentially input discrete variate and/or continuous variate so as to detect the outlier~~ a sequentially input discrete variate and/or continuous variate so as to detect the outlier ~~and the change point allow for detection of outliers and change points of said data, said~~ and the change point allow for detection of outliers and change points of said data, said outlier and change point detection device comprising:

a first time-series model learning device that learns the generation mechanism for
learning a probability distribution for of the read data series as the a time-series statistic
model specified by the a finite number of parameters; and

an outlier score calculator that reads the value of for reading the parameters obtained
through learning by said first time-series model learning device, calculates and for calculating
the an outlier score of the data based on the read parameter parameters of the time-series
statistic model and the input data, and outputs the for outputting the outlier score results;

a moving average calculator for sequentially reading each outlier score calculated by
said outlier score calculator, and for calculating a moving average of the read outlier scores;

a second time-series model learning device for sequentially reading each moving
average of the read outlier scores calculated by said moving average calculator, and for
learning a particular probability distribution for the read moving averages as a particular time-
series statistic model specified by a finite number of particular parameters; and

a change point score calculator for reading the particular parameters obtained through
learning by said second time-series model learning device, and for calculating a particular
outlier score for each moving average calculated by the moving average calculator based on
the read particular parameters of the particular time-series model and the moving average
calculated by the moving average calculator, and for outputting the particular outlier score for
each moving average as a change point score of the data.

3. (Cancelled)

4. (Currently Amended) ~~An~~ The outlier and change point detection device as set forth in ~~claim 3 of claim 2,~~

wherein said first time-series model learning device ~~learns~~ is configured to learn, in a case where the sequentially input data are described with continuous variate only, the probability distribution for generation of said data string with while sequentially reading the data strings of the real number vector values of the data and by using the an autoregressive model; and

wherein the first time-series model learning device further comprises:

a data updating device ~~to update the~~ for updating a sufficient statistic of the autoregressive model ~~with by forgetting the at least a portion of past data that has been read and using the newly read data of said data;~~ and

a parameter calculator ~~to read~~ for reading the sufficient statistic updated by said data updating device, ~~and to calculate the~~ for calculating a specific parameter of the autoregressive model using the sufficient statistic.

5. (Currently Amended) ~~An~~ The outlier and change point detection device as set forth in ~~claim 3 of claim 2,~~

wherein said outlier score calculator and said change point score calculator are considered as a single score calculator; and

wherein the outlier and change point detection device further comprising as comprises:

~~a device to determine the candidates of outliers and change points in the series for the data series described in discrete and/or continuous variates;~~

a sort device ~~to sort~~ for sorting the data in descending order based on the outlier score scores and the change point score scores calculated by said score calculator; and

the a display device ~~that displays the~~ for displaying a particular number of data pieces of said data with ~~higher~~ high scores according to the order sorted by said sort device as the candidates ~~of~~ for being outliers and change points of the data.

6. (Currently Amended) ~~An~~ The outlier and change point detection device ~~as set forth in claim 3 of claim 2,~~

wherein said outlier score calculator and said change point score calculator are considered as a single score calculator; and

wherein the outlier and change point detection device further comprising, comprises:
as a device to determine candidates of outliers and change points in the series for the data described in discrete and/or continuous variates sequentially input,

a score judgement device that outputs for outputting data pieces of the data that are over the a predetermined threshold from the outlier score and the change point score calculated by said score calculator as the candidates of outliers or change points.

7. (Cancelled)

8. (Currently Amended) ~~An outlier and change point detection method to detect~~ used for machine learning or data mining to detect candidate the outlier outliers and change point points in a data series by calculating the outlier score scores and the change point score scores for the a plurality of data pieces of the data series described with the sequentially input discrete variate and/or continuous variate, said method comprising the steps of:

sequentially reading each data piece of the plurality of data pieces of the data series, and, for each data piece of the plurality of data pieces, performing processing when the data piece is read, said processing comprising:

a learning step of learning the mechanism to generate at least one corresponding parameter of a corresponding probability distribution of a corresponding time-series statistic model related to the read data piece series as a time-series statistic model specified by the finite number of parameters, and based on one or more first data pieces that have already been read among the plurality of data pieces;

an outlier score calculation step of reading the parameter value obtained through learning by said learning step and calculating the a corresponding outlier score of each the data piece based on the read at least one corresponding parameter of the time-series

~~model and~~ one or more second data pieces that have already been read among the plurality of data pieces ~~the input data and outputting the results;~~

calculating, for the data piece, a corresponding moving average based on one or more previously calculated outlier scores for one or more third data pieces that have already been read among the plurality of data pieces;

learning at least one corresponding particular parameter of a corresponding particular probability distribution of a corresponding particular time-series statistic model related to the corresponding moving average based on one or more previously calculated moving averages for one or more fourth data pieces that have already been read among the plurality of data pieces;

calculating a corresponding outlier score of the corresponding moving average associated with the data piece based on the at least one corresponding particular parameter and one or more previously calculated moving averages for one or more fifth data pieces that have already been read among the plurality of data pieces; and

outputting the corresponding outlier score of the corresponding moving average associated with the data piece as the change point score of the data piece.

9. (Cancelled)

10. (Currently Amended) ~~An~~ The outlier and change point detection method ~~as set forth in claim 9 of claim 8,~~

wherein, in case the sequentially input read plurality of data pieces are described with a continuous variate only, said learning step of learning said at least one corresponding parameter comprises:

sequentially reads the data string of the real number vector values and learns learning the at least one corresponding parameter of the corresponding probability distribution for generation of said data string using the an autoregressive model; and;

updates the updating a sufficient statistic of the autoregressive model with forgetting the past data using the newly read data piece while forgetting one or more past data pieces that were read before said data piece among said plurality of data pieces; reads said updated sufficient statistic; and

~~calculates~~ calculating the at least one corresponding parameter of the corresponding probability distribution of the autoregressive model using the sufficient statistic.

11. (Currently Amended) ~~An~~ The outlier and change point detection method-as set forth in ~~claim 9 of claim 8, wherein further comprising:~~

~~said outlier score calculation step and said change point score calculation step are considered as a single score calculation step and further comprising:~~

~~a step in which, as a method to determine candidates of outliers and change points in the series for the data series described with discrete and/or continuous variates, the data are sorted~~ sorting the plurality of data pieces in a descending order based on said calculated the corresponding outlier score scores and the corresponding change point score scores; and

~~the higher score data are displayed~~ displaying a predetermined number of the plurality of data pieces that are at a top of the sorted order of the plurality of data pieces as the outlier and change point candidates according to the order of sorting of the data series.

12. (Currently Amended) ~~An~~ The outlier and change point detection method-as set forth in ~~claim 9 of claim 8, wherein further comprising:~~

~~said outlier score calculation step and said change point score calculation step are considered as a single score calculation step and further comprising a step in which, as a method to determine outlier and change point candidates in the series,~~ selecting particular data pieces of the plurality of data pieces that have corresponding outlier scores and corresponding change point scores over the predetermined threshold thresholds selected from said calculated outlier and change point scores as the candidates of candidate outliers or change points for the data series described with discrete variate sequentially input and/or continuous variate.

13. (New) A device for inputting a plurality of data pieces of a data series and for calculating outlier scores and change point scores for the plurality of data pieces to be used for performing data mining with respect to the data series, said device comprising:

a first time-series model learning device for sequentially inputting each data piece of the plurality of data pieces, and for learning, for each data piece of the plurality of data pieces when the data piece is input, a corresponding parameter of a probability density function related to the data piece based on one or more data pieces of the plurality of data pieces that have already been input to the first time-series model learning device;

an outlier score calculator for inputting, for each data piece of the plurality of data pieces, the data piece and the corresponding parameter learned by the first time-series model learning device, and for calculating, for each data piece of the plurality of data pieces, a corresponding outlier score based on the corresponding parameter and one or more data pieces of the plurality of data pieces that have already been input to the outlier score calculator;

a moving average calculator for sequentially inputting the corresponding outlier score calculated by the outlier score calculator for each data piece of the plurality of data pieces, and for calculating, for each data piece of the plurality of data pieces, a corresponding moving average based on one or more of the outlier scores from the outlier score calculator that have already been input to the moving average calculator;

a second time-series model learning device for sequentially inputting the corresponding moving average calculated by the moving average calculator for each data piece of the plurality of data pieces, and for learning, for each data piece of the plurality of data pieces when the corresponding moving average is input, a corresponding particular parameter of a particular probability density function related to the corresponding moving average based on one or more moving averages from the moving average calculator that have already been input to the second time-series model learning device; and

a change point score calculator for inputting, for each data piece of the plurality of data pieces, the corresponding moving average calculated by the moving average calculator and the corresponding particular parameter learned by the second time-series model learning device, and for calculating, for each data piece of the plurality of data pieces, a corresponding change point score based on the corresponding particular parameter and one or more moving averages from the moving average calculator that have already been input to the change point score calculator.